Impact of Oral Meloxicam on Circulating Physiological Biomarkers of Stress and Inflammation in Beef Steers After Long Distance Transportation

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Summary and Implications

We hypothesized that meloxicam administration to beef steers before shipping may be effective at reducing the impact of transportation on stress biomarkers. Circulating physiological biomarkers of stress were analyzed in a transportation trial between a meloxicam treatment group and a placebo treatment group. There were significant differences in stress biomarkers between treatment groups following transport. This suggests that there may be practical benefits for the use of long-acting non-steroidal anti-inflammatory drugs (NSAIDs), specifically meloxicam, to mitigate the negative effect of transport on cattle physiology.

Introduction

Long distance transportation of calves intended for beef production is a common practice in the United States. Immunosuppression after transportation predisposes calves to developing bovine respiratory disease (BRD), which commonly occurs in the first 45 days of arrival and is associated with 65 to 80 % morbidity and 35 - 55 % mortality. BRD is estimated to cost the beef industry $500 million annually. Therefore, even a modest reduction in stress after transportation could have a significant economic benefit for livestock producers.

Transportation is associated with an increase in circulating pro-inflammatory cytokines in cattle leading to the initiation of an inflammatory reaction. Previous studies support the hypothesis that extended exposure to a non-steroidal anti-inflammatory drug (NSAID) may reduce stress and improve performance after castration and dehorning. Meloxicam is an NSAID approved in Canada for pain relief in calves after disbudding. Meloxicam was found to reduce the incidence of BRD in calves after castration when administered on arrival at the feedlot. However, a similar effect was not observed in calves received as steers. The objective of this study was to assess stress biomarkers and inflammatory mediators in beef steers that received oral meloxicam or a placebo before long distance transportation.

Materials and Methods

Ninety-seven medium-large frame, horned & polled, Brahman, and Angus X Brahman crossbred steers aged 15 to 17 months, weighing 201 to 465 kg were procured from the Brown Loam Experiment Station at the Mississippi State University research farm near Raymond, MS after a 32 week backgrounding period. Calves were blood sampled at time point 0 hour. After sampling, treatment with either meloxicam or placebo was initiated. Calves were shipped approximately 1,316 km from Raymond, MS to a feedlot facility near Tabor, IA in 2 truckloads carrying 48 and 49 calves respectively. Loading was coordinated for the trucks to arrive at the 24 hour time point. Then, after a 16 hour transportation event that concluded approximately 24 hours after baseline blood collection occurred, a follow up sampling took place at 144 hours.
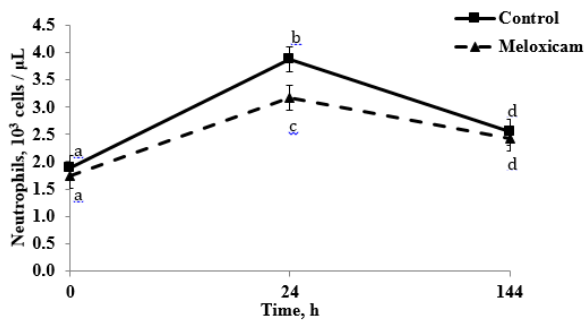
Results and Discussion

An increase in neutrophil, platelet, monocyte, white blood cell and red blood cell counts occurred after transportation ($P < 0.0001$) and a decrease in lymphocyte count was observed ($P < 0.0001$). Meloxicam treatment reduced the stress-induced neutrophilia ($P = 0.0072$) shown in Figure 1, and circulating monocyte count ($P = 0.013$) on arrival shown in Figure 2. Mean corpuscle hemoglobin ($P = 0.05$), mean corpuscle volume ($P = 0.05$) and lymphocyte count ($P = 0.05$) was also greater in the placebo calves

compared with meloxicam calves after transportation. Furthermore, HP-MMP-9 complexes, TCO_2, TNFα, plasma proteins and SP increased. Cortisol decreased after shipping ($P < 0.01$). MEL treatment tended to reduce serum cortisol concentrations ($P = 0.08$) and there was evidence of a time-by-treatment interaction ($P = 0.04$). An inverse relationship between plasma MEL concentrations and circulation cortisol concentrations ($P = 0.002$), neutrophil ($P = 0.04$) and basophil counts ($P = 0.03$) was also observed. The results suggest that meloxicam administration may reduce the impact of long-distance transportation on circulating physiological biomarkers of stress and inflammation in beef calves.

Figure 1. Neutrophil levels between treatment groups over time.

Figure 2. Monocyte levels between treatment groups over time.